85000410

Centre Number Examination Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Chemistry

Paper 2 Theory





2020

Additional materials:

Calculators (non-programmable) Graph paper

Time: 2 hours

Marks: 80

Instructions to Candidates

- 1 Write the **centre number** and your **examination number** on **every page** of this question paper and on the separate **Answer Booklet/Paper** provided.
- 2 There are twelve (12) questions in this paper.
 - (i) Section A

Answer all questions.

Write your answers in the spaces provided on the question paper.

(ii) Section B

Answer any three questions.

Write your answers in the separate Answer Booklet provided. At the end of the examination, fasten your Answer Booklets securely to the question paper.

Information for Candidates

- **1** The number of marks is shown in brackets [] at the end of each question or part question.
- 2 The **Periodic Table** is on page 14.
- 3 Cell phones are not allowed in the examination room.

| For Exa | miner's Use |
|-----------|---------------------------------|
| Section A | |
| Section B | |
| В9 | |
| B10 | ESCSCSESES CSCSCSESESES |
| B11 | SESESES OUTS SESES OUTS OUTS |
| B12 | |
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This question paper consists of 14 printed pages

Page 2 of 14

| Centre Number | Exa | amination Num | per |
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| | | | |

Section A: [50 marks]

Answer all questions in the spaces provided.

| A1 | (a) | (i) | Explain why most laboratories do not have floors. | smooth floors, but have rough |
|-----------|-----|-------|--|----------------------------------|
| | | | | [1] |
| | | (ii) | Give two laboratory safety rules you would out a titration. | need to observe when carrying |
| | | | | [2] |
| | (b) | Draw | the arrangement of particles in a solid, liquid | and gas in the spaces below. |
| | | | Solid Liquid | Gas [3] |
| | (c) | Expla | in why | [3] |
| | | (i) | for the same space occupied, solids have h gases. | igher densities than liquids and |
| | | (ii) | gases are compressible. | [1] |
| | | () | | [1] |
| | | | | [Total: 8] |

| Examination Number | | | |
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Page 3 of 14

- A2 Crystals of copper (II) sulphate (CuSO₄. 5H₂O) are obtained from aqueous solutions of copper (II) sulphate (CuSO₄)
 - (a) State the four steps (processes) in their correct order, and for each step give the reason for carrying out such a step, in obtaining the crystals.

| (i) | Step 1: | |
|-------|---------|-----|
| | | |
| | Reason: | |
| | | [1] |
| (ii) | Step 2: | |
| | | |
| | Reason: | |
| | | [1] |
| (iii) | Step 3: | |
| | | |
| | Reason: | |
| | | [1] |
| (iv) | Step 4: | |
| | | |
| | Reason: | |
| | | E43 |

Chemistry/5070/2/2020

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[Total: 4]

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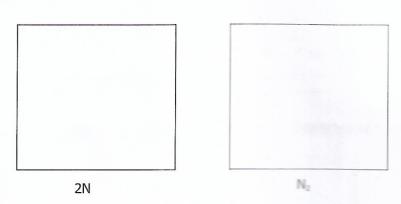
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A3 (a) A coefficient and subscript on the symbol of nitrogen atom (N) mean different notations in chemistry.

(i) What is the significant difference between the two notations 2N and N_2 ?

Г1

(ii) Draw the dot and cross structures showing outer shells only for the two notations.



[2]

- (b) Both carbon tetrachloride (CCl₄) and Potassium chloride (CCl₄) are compounds of chlorine.
 - (i) Compare the electrical conductivity of liquid carbon terrachloride and liquid potassium chloride.

[1]

(ii) Which of the **two** compounds has a higher meting point? Explain your answer.

.....[2]

[Total: 6]

| Centre Number | Examination Number |
|---------------|--------------------|
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500041

2020

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| Section A | |
| Section B | |
| В9 | |
| В10 | |
| B11 | ESESOSOCIESESE ESESESESES ESESESESESES |
| B12 | 8666666 6566666 |
| Total | |

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| Centre Number | Examination Number | | |
|---------------|--------------------|--|--|
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Page 5 of 14

A4 A sample of 0.03g of small pieces of magnesium was added to 20cm³ of 0.10mol/dm³ of hydrochloric acid. The two reacted according to the equation below.

 $\text{Mg}_{(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{MgCl}_{2\,(aq)} + \text{H}_{2(g)}$

(a) (i) Write the word equation for the above reaction.

.....[1]

(ii) What is the chemical test for hydrogen gas?

______[1]

(b) (i) Calculate the mass of magnesium which was in excess.

[4]

(ii) Calculate the volume of hydrogen that would be produced at r.t.p.

[2]

[Total: 8]

Turnover

Chemistry/5070/2/2020

| Page | 6 | of | 1 | 4 |
|------|---|----|---|---|
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| Centre Number | Examination | Number |
|---------------|-------------|--------|
| 344 | | |

| A5 (a) Use the Periodic Ta | able to state the |
|----------------------------|-------------------|
|----------------------------|-------------------|

| | (i) | name of the element with electronic configuration: 2,8,18,7 | |
|-----|-------|---|-----------------|
| | | | [1] |
| | (ii) | chemical symbol of the element that forms an acidic oxide of formula as its only oxide, | KO ₂ |
| | | | [1] |
| | (iii) | name of the most electronegative halogen, | |
| | | | [1] |
| | (iv) | name of the element in Group V and period 3, | |
| | | | [1] |
| | (v) | number of metals in Group IV. | |
| | | | [1] |
| (b) | | ers. If element C is a noble gas, state the | |
| | (i) | formulae of the ions formed by B and E. | |
| | | | |
| | | | [2] |
| | (ii) | only noble gas that cannot be C. | |
| | | | |
| | | | [1] |
| | | [Tota | l: 8] |

| Centre Number | Examination Number |
|---------------|--------------------|
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(ii)

Page 7 of 14

A6 Choose from the list of oxides given below to answer the questions that follow. An oxide may be chosen once, more than once or not at all.

Al₂O₃, CaO, CO₂, CO, Fe₂O₃, H₂O, ZnO

(a) Which **two** oxides are amphoteric?

[2]

(b) Which **two** oxides are neutral?

[2]

(c) State the other **two** types of oxides. Give an example of each type of oxide from the table.

(i)

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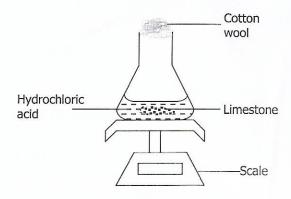
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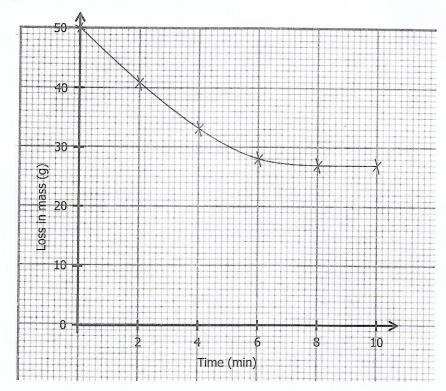
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Centre Number Examination Number

A7 The diagram below was used to measure the rate of reaction. The initial mass of the beaker and its contents was 50.0g.



The graph below also shows how the reaction between limestone and hydrochloric acid proceeded with time.



| Centre Number | Examination Number | |
|---------------|--------------------|--|
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Page 9 of 14

- (a) What mass of carbon dioxide was lost when the reaction went to completion?

 [1]

 (b) Calculate the mass of calcium carbonate used in the first 1 minute.

 [2]
 - (c) On the same graph, sketch how the curve would appear if powdered limestone was used. [1]

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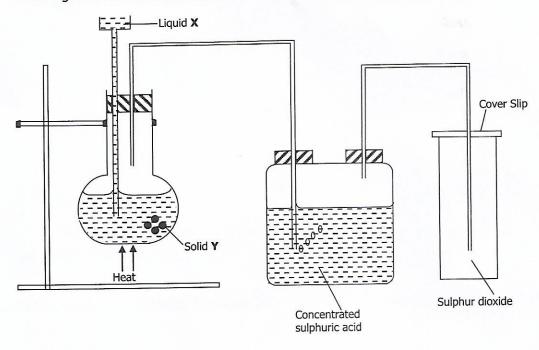
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Turnover

Chemistry/5070/2/2020

| Centre Number | Examir | ation Nur | nber | |
|---------------|--------|-----------|------|---|
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| | | | 1 1 | |

A8 The diagram below shows laboratory preparation of sulphur dioxide.



| (a) | Name the reactants X and Y . | |
|-----|---|-----|
| | | [2] |
| (b) | Write a balanced chemical equation for the reaction in (a) above. | |
| | | [2] |
| (c) | What is the chemical test for sulphur dioxide? | |
| | | [1] |
| (d) | Why is the gas passed through concentrated sulphuric acid? | |

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[1]

[Total: 6]

| Centre Number | Examination Number | |
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| | | |

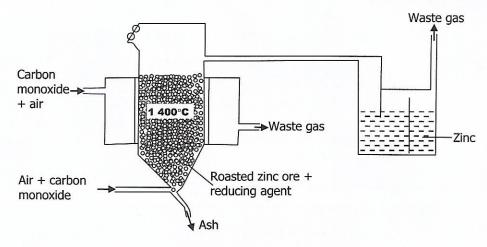
Page 11 of 14

Section B (30 marks)

Answer three questions from this section.

Write your answers in the separate Answer Booklet provided.

B9 Zinc is extracted from its sulphide ore, zinc blende, in a blast furnace shown below.



- (a) What reducing agent is used in the extraction process shown above? [1]
- (b) Name another ore from which zinc can be extracted. [1]
- (c) Write a balanced chemical equation for the reaction which occurs when zinc blende is roasted in air. [2]
- (d) Name a pollutant gas which is produced when zinc blende is roasted in air. [1]
- (e) Describe how the named pollutant in (d) is converted to a useful product in industry. [3]
- (f) (i) Zinc is often alloyed with other metals. Name an element which is alloyed with zinc to form brass. [1]
 - (ii) Give one use of brass. [1]

[Total: 10]

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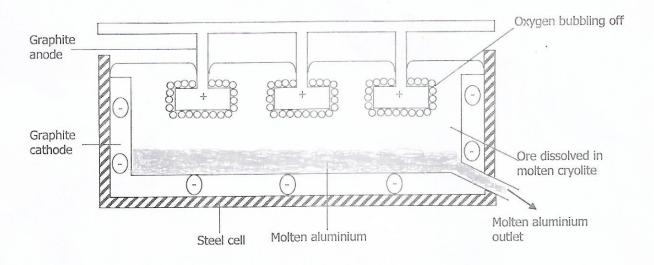
Chemistry/5070/2/2020

Turnover

Page 12 of 14

| Centre Number | Examination Number | |
|---------------|--------------------|--|
| | | |

B10 The diagram below shows how aluminium is extracted in industry.



- (a) Name the ore from which aluminium can be extracted. [1]
- (b) Why is aluminium oxide dissolved in cryolite? [1]
- (c) Which electrode has to be frequently replaced during the process? Explain your answer. [2]
- (d) Write equations for the reactions taking place at the anode and cathode. [2]
- (e) Aluminium is used to make pots and pans because it is a good conductor of heat and it is light. Give another property of aluminium that makes it suitable to be used for making pots and pans.

 [1]
- (f) A current of 50A is passed in the electrolyte for 1 hour. Calculate the mass of aluminium that will be produced. (1F = 1 mole of electrons = 96 500C) [3]

[Total: 10]

| Centre Number | Examin | ation Numb | per | |
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Page 13 of 14

- B11 The molar enthalpy changes of combustion of the first 4 alkanes are given as follows from calorimetric combustion analysis:
 - -890kJ/mol, -1 600kJ/mol, -2 220kJ/mol and -2 880kJ/mol, respectively.
 - (a) Suggest the molar enthalpy of combustion of the fifth alkane. [1]
 - (b) Explain why the amount of heat energy produced increases consecutively when 1 mole of each alkane burns completely. [2]
 - (c) Write the balanced equation for the complete combustion of the second alkane showing the enthalpy of combustion. [2]
 - (d) Use the following bond energies to calculate the ΔH for the reaction:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

| Bond | Bond energy kJ/mol |
|------|--------------------|
| С—Н | 412 |
| 0=0 | 490 |
| C=0 | 826 |
| O-H | 464 |

(ii) Draw an energy level diagram for the combustion of methane?

[5]

[Total: 10]

The following table shows information about some homologous series of organic compounds. Each compound shown is the second member of the homologous series.

| Homologous series | IUPAC name of compound | Displayed structure | | |
|-------------------|------------------------|---------------------|--|--|
| Alkanes | | | | |
| | Ethanol | | | |
| | | H O H C O H | | |
| | | Н | | |
| Alkenes (Olefins) | | _ | | |

N.B: Each homologous series has an alternative name.

(a) Copy and complete the table.

[4]

(b) The third member in the family of alkenes is isomeric. Draw **two** of the isomers and give the IUPAC name of each isomer.

[4]

(c) The formula C₂H₄O₂ generates two different compounds A and B.
A is sweet smelling while B choke(s, but reacts with Na₂CO₃ to produce CO₂.
Identify A and B by their structures.

[2]

[Total: 10]

DATA SHEET

Page 14 of 14

The Periodic Table of the Elements

| Key a | *58-71 Lanthanoid series +90-103 Actinoid series | Fr Francium 87 | 133 Cs Caesium 55 | Rb Rb Rubidium | 39 X Potassium | Lithium 3 23 23 Na Sodium | _ | Group |
|---|---|----------------------------------|-------------------------------------|-------------------------------------|------------------------------------|---|---------------|----------|
| | thanoid s ctinoid se | 226 Ra Radium 88 | 137 Ba Barium 56 | Strontium | Calcium 20 | Be Beryllium 4 24 24 Mg Magnesium | = | = |
| a = relative atomic massX = atomic symbolb = proton (atomic) number | ries | Ac Actinium + | 139 La Lanthanum 57 | 89 Y Yttrium | 45 Sc Scandium 21 | | | |
| number | | | 178 Hf Hafnium 72 | 91 Zr Zirconium 40 | Ti Titanium 22 | | | |
| 232 Th Thorlum 90 | 140 Ce Cerlum 58 | | 181 Ta Tantalum 73 | 93 Nb Niobium 41 | Vanadium 23 | | | |
| Pa Protactinium 91 | Pr Pr Praseodymium 59 | | 184 W Tungsten | 96 Mo Mo Molybdenum 42 | 52 Cr Chromium 24 | | | |
| 238 U Uranium 92 | Neodymium 60 | | 186 Re Rhenium 75 | Tc Tchnetium 43 | Mn Mn Manganese 25 | | | |
| Np Neptunium | Pm Promethium 61 | | 190 Os Osmium 76 | 104 Ru Ruthenium 44 | 56 Fe Iron | | 1 Hydrogen | |
| Pu Plutonium 94 | Sm Samarium 62 | | 192 Ir Iridium 77 | 103 Rh Rhodium 45 | Cobalt 27 | 34 | | |
| Am Americium 95 | 152 Eu Europium 63 | | 195 Pt Platinum 78 | 106 Pd Palladium 46 | 59 Ni Nickel | | | |
| Cm Curium | 157 Gd Gadoliniu m 64 | | 197 Au Gold 79 | 108 Ag Silver 47 | 64 Cu Copper 29 | | | |
| Bk Berkelium 97 | 159 Tb Terbium 65 | | 201 Hg Mecury 80 | 112 Cd Cadmium 48 | 65 Zn Zinc | | | |
| Cf Californium 98 | Dy Dysprosium | | 204 T/ Thallium 81 | 115 In Indium 49 | Gallium | Boron 5 | | |
| Es Einsteinium | Ho Ho Holmium 67 | | 207 Pb lead 82 | 119 Sn Th | 73 Ge Germanium 32 | Carbon 6 28 Silicon | | 7.7 |
| Fm Fermium | 167 Er Erbium 68 | | 209 Bi Bismuth | 122 Sb Antimony 51 | 75 As Arsenic | Nitrogen 7 31 Phosphorus 15 | < | |
| Md Mendelevium 101 | 169 Tm Thulium | | Po Polonium 84 | 128 Te Tellurium | 79 Se Selenium 34 | Oxygen 8 | <u> </u> | 1/1 |
| No Nobelium | Yb Ytterbium | | At Astatine 85 | 127 I lodine 53 | 80 Br Bromine 35 | Fluorine 9 35.5 C/ Chlorine 17 | <u> </u> | M |
| Lawrenciu | 175 Lu 1 Lute: 17 | | Rado | 131 Xe Xeno 54 | 84 X, Kryptc | 10 Neon 40 Argor 18 | 4 + 4 Pellur | > |